

Class- B.Sc.
Semester I
Subject- Botany
Unit III - Phycology

Topic - Classification and Life Cycle of -
Sargassum, Ectocarpus

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Class - Phaeophyceae

General Characters:

The Phaeophyceae, or **brown algae**, derive their characteristic color from the large amounts of the carotenoid **fucoxanthin**.

They are almost exclusively **marine**.

There are no unicellular or colonial organisms in the order, and the algae are basically **filamentous, pseudoparenchymatous, or parenchymatous**.

Zoospores or gametes have a **long anterior tinsel flagellum** and a **shorter posteriorly directed whiplash flagellum** (there are no motile vegetative cells).

The **cell wall** is made up of **alginic acid and fucoidan**.

Chloroplast have **stalked pyrenoid** with pyrenoid sac containing the reserve food.

The **storage product** is **laminarin and mannitol**.

Life cycle may be **diplontic** (*Sargassum*), **isomorphic** (*Ectocarpus*) or **heteromorphic** (*Laminaria*).

Genus- *Sargassum*

Classification:

Class: Phaeophyceae

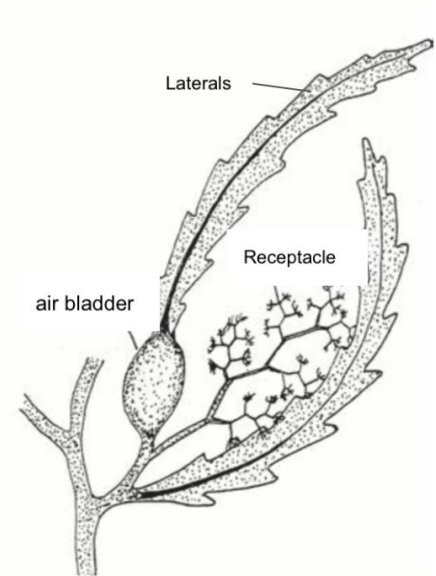
Order: Fucales

Family: Sargassaceae

Genus: *Sargassum*

The Sargasso Sea is in the Atlantic Ocean and is made up of huge masses of floating Sargassum (**gulfweed**) .

Masses of Sargassum are formed by continuous vegetative reproduction of the plants.



https://www.researchgate.net/figure/Sargassum-natans-type-I-Puerto-Morelos-Scale-bar-1-cm_fig3_350999657

Genus- *Sargassum*

Thallus Structure

The plant body is differentiated into a **holdfast**, a short **stipe** and much branched **axis**.

Axis bears **leafy laterals**.

From near the axil of the leafy laterals (called primary branch), comes out a second order of branches.

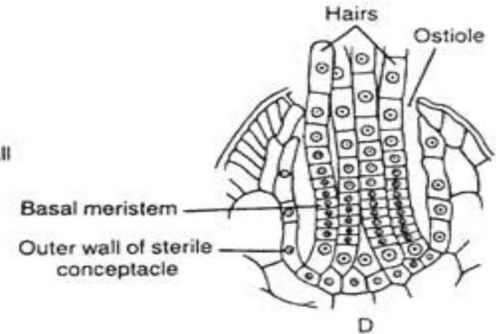
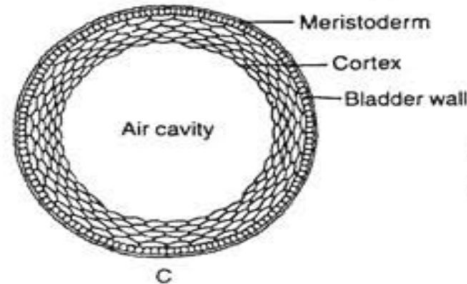
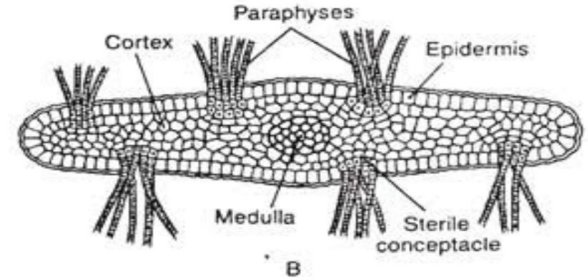
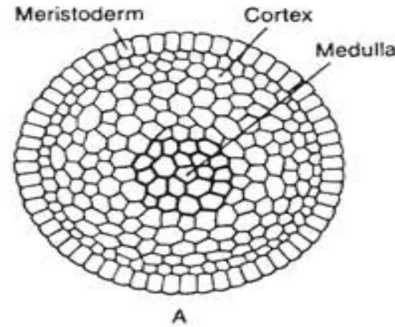
Few branches transform into **air bladders** and the remaining branches serve as **receptacles** bearing **fertile conceptacles**.

The laterals have smooth or serrate margins and are often provided with a prominent midrib.

Genus- *Sargassum*

A transverse section through a branch, leaf or stipe shows well-marked differentiation into three regions,

- **meristoderm**
- **cortex** and
- **medulla**



A. T.S of axis; B. T.S of lateral; C. T.S of air bladder;
D. V.S of sterile conceptacle

Genus- *Sargassum*

Reproduction

Vegetative: *S. natans* and *S. hystrix*, which grow free-floating in the Sargasso Sea, are known to multiply exclusively by vegetative means.

Genus- *Sargassum*

Sexual reproduction: Species are both dioecious and monoecious.

Sargassum forms special branches called **receptacles** that bear **fertile conceptacles**.

Antheridia are formed in the **male conceptacle**.

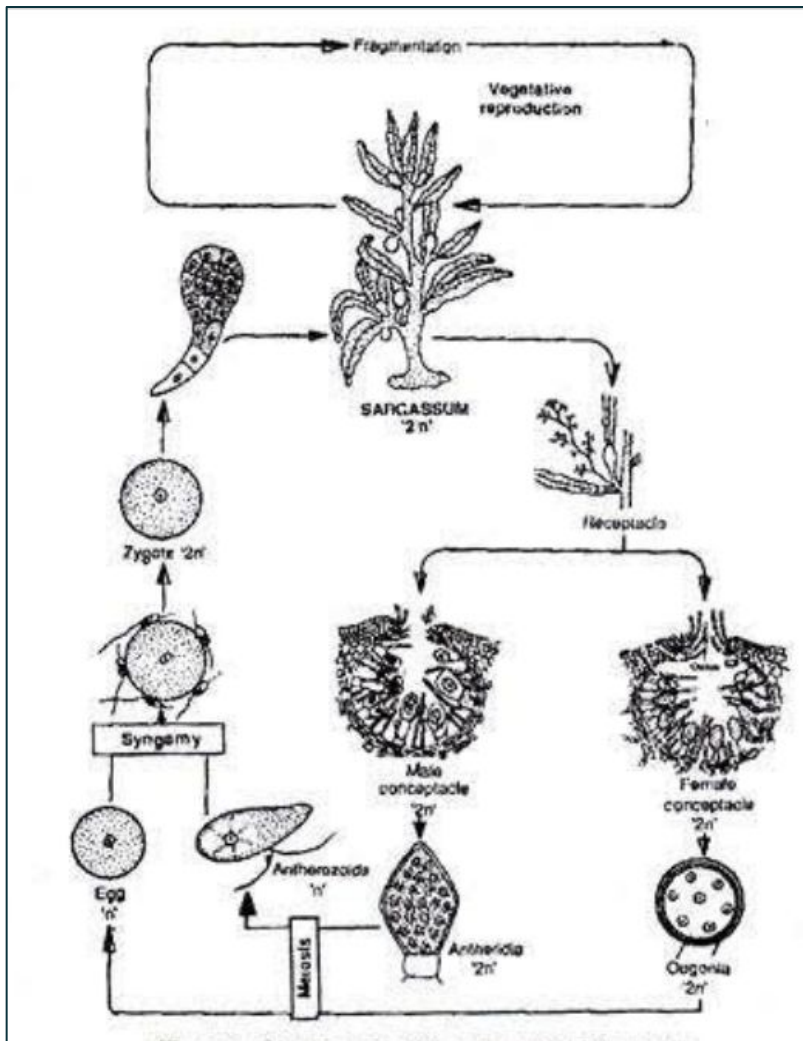
Antheridial protoplast fragments into 64 uninucleate, antherozoids bearing two lateral flagella of unequal length and containing a large nucleus, vestigial chromatophore and eye spot.

Genus- *Sargassum*

During **ogonial development**, **7 out of the 8 nuclei degenerate** and the remaining nucleus along with the oogonial cytoplasm forms a **single egg**.

After maturation of the oogonium, the outer wall layer ruptures and the **middle layer develops into a mucilaginous stalk** which pushes the entire oogonium through the ostiole to the exterior while still attached to the mother plant.

Fertilization occurs while the oogonium is attached to the conceptacle through mucilaginous stalk.



Life cycle of *Sargassum*

Genus- *Ectocarpus*

Classification:

Class: Phaeophyceae

Order: Ectocarpales

Family: Ectocarpaceae

Genus: *Ectocarpus*

Occurrence

Worldwide in distribution, *Ectocarpus* is a **marine** alga. In India it is mostly found in the supralittoral zone along the West and East Coasts.



Thallus under microscope

<https://alchetron.com/Ectocarpus>

Habit

<https://commons.wikimedia.org/wiki/>

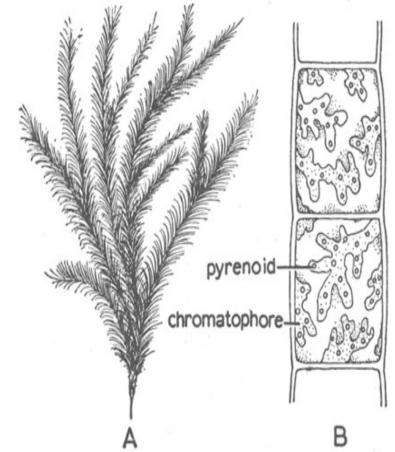
Category:Ectocarpus

Genus- *Ectocarpus*

Thallus is **heterotrichous**.

The thallus is made up of **uniseriate filaments** and is generally differentiated into a much branched **erect system** and a **prostrate system**.

The plants are attached to the substratum by branched **rhizoids** produced from lower cells of lower branches



Genus- *Ectocarpus*

The cells are eukaryotic and uninucleate.

Alginic acid and fucoidan are present in the cell wall.

They have an irregular **band-shaped**, or many **discoïd chromatophores** .

Fucoxanthin is the dominant pigment.

Reserve food is **laminarin and mannitol**.

The chromatophore contains a **projecting pyrenoid** .

Pyrenoid sac is present around the pyrenoid.

Genus- *Ectocarpus*

Asexual Reproduction

The sporophyte produces **unilocular** as well as **plurilocular sporangia**.

The diploid nucleus of the **unilocular sporangium** undergoes a **meiotic division** and then many **mitotic divisions** until **32-64 haploid nuclei** are formed.

Sporangial protoplast divides into a number of uninucleate segments each with a single chromatophore is transformed into a **haploid, biflagellate, pyriform zoospore** in which the **anterior longer flagellum is pantonematic** and the **posterior shorter flagellum is acronematic**.

Genus- *Ectocarpus*

The **plurilocular sporangium** undergoes a series of transverse and vertical mitotic divisions producing several hundred small cubical cells arranged in definite tiers.

Each cell is diploid, uninucleate and forms a single **diploid biflagellate zoospore**.

The **haploid zoospores from unilocular sporangia form gametophytes** whereas the **diploid zoospores from a plurilocular sporangium produce sporophytes**.

Genus- *Ectocarpus*

Sexual reproduction: The plurilocular gametangia arise in a manner similar to plurilocular sporangia of the diploid sporophyte.

Gametes produced singly from each locule are also of equal size (isogametes) and are morphologically identical with the zoospores.

Sexual reproduction may be isogamous though sometimes it may be by physiological or morphological anisogamous.

Genus- *Ectocarpus*

In *E. siliculosus*, several male gametes cluster around a single female gamete with their longer flagella attached to its surface (**clump formation**).

Morphologically **female gametes** are known to produce a **volatile sexual attractant** which causes clumping of the male gametes).

Ultimately one of the male gamete fuses with the female .

The **zygote germinates without meiosis forming the sporophytic plant.**

Genus- *Ectocarpus*

Alternation of generation

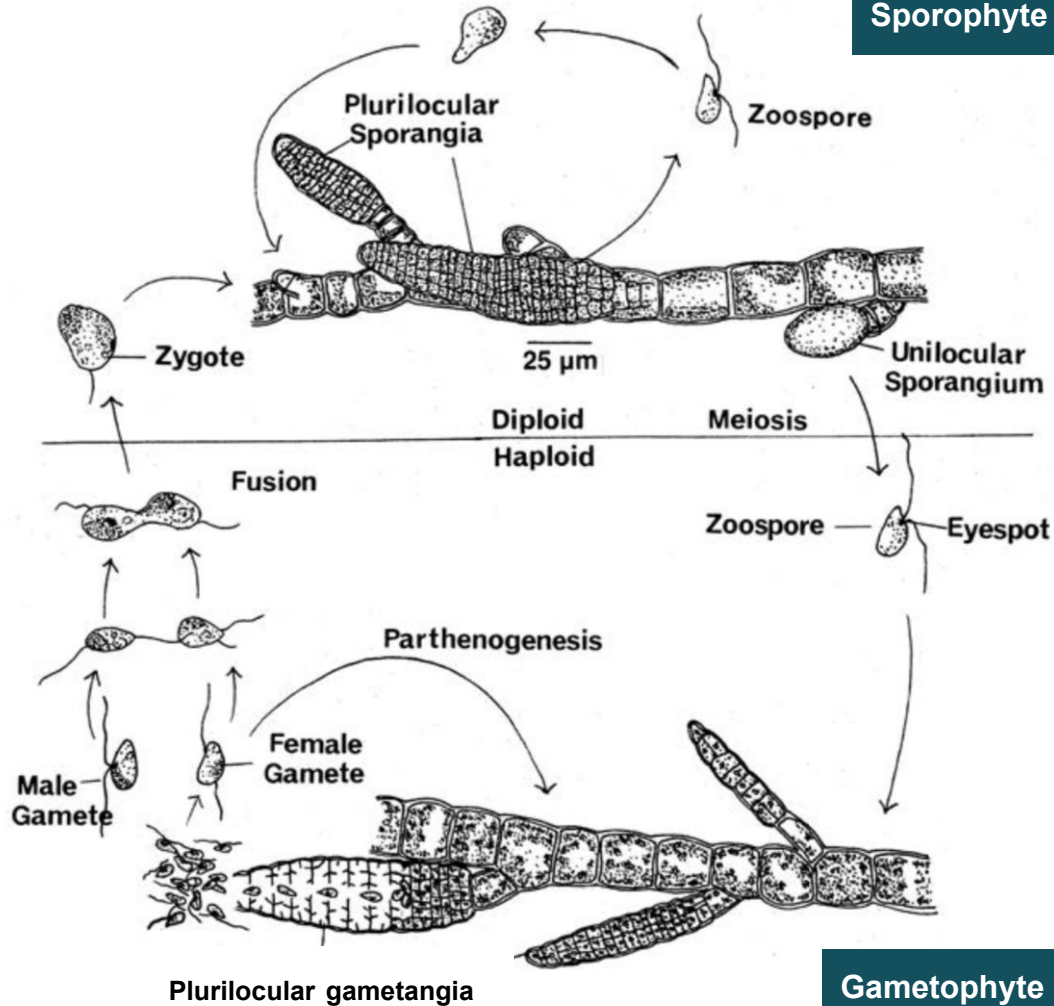
Sexual/ gametophytic plants of *Ectocarpus* are dioecious and form only plurilocular gametangia.

The zygotes upon germination do not divide meiotically and produce diploid asexual/ sporophytic plants.

But during the formation of zoospores in unilocular sporangia, the first nuclear division is always meiotic and therefore such zoospores are haploid and germinate into haploid gametophytic plants.

The gametophytic and sporophytic generations of *Ectocarpus* are morphologically- alike and therefore, its life cycle is isomorphic.

Sporophyte



Life cycle of Ectocarpus

Gametophyte

Let's revise

Q.1 What is the common name of Sargassum?

Q.2 Describe the thallus structure of Sargassum.

Q.3 Give a detailed account of sexual reproduction of Sargassum.

Q.4 Write a note on (a) Plurilocular sporangia (b) Clump formation

Q.5 Describe Isomorphic alternation of generation found in Ectocarpus.